

# DIY

*Worthwhile projects you can build on your own*



## NVIS antenna for 40 and 80 meters

In a previous issue of *UVARC Shack* ([January 2018](#), p. 15), we featured a pseudo-Yagi NVIS antenna that worked marginally well, but not close enough for government work. This time we're spotlighting an NVIS antenna promoted by [DX Engineering](#) and patterned after one that was used by the US Army, the [AS-2259/GR](#). The two unique and immediately apparent features of this version are the inverted-V formation and the cross-element layout.

This design is so simple that it can be described as two perpendicular inverted-V dipoles, each using the other as a capacitance match, relieving the need for a discrete matching device. The coax center conductor connects to one element of both, and the shield to the other two. The transformer-less "balun" (actually nothing more than a center insulator) and feed point are then raised about 16 feet, and you have yourself an NVIS antenna. Let's build it

### Parts list

- |   |   |
|---|---|
| 130 feet of <a href="#">14 AWG stranded wire</a>  | 12" <a href="#">14 AWG speaker wire pair</a>          |
| Two <a href="#">1-¼" PVC slip caps</a>  | One <a href="#">1-¼" 24" long PVC tube</a>            |
| Five <a href="#">1-½" x 3/16" eye bolts</a>   | Eight <a href="#">14 AWG #8 stud ring terminals</a>   |
| One <a href="#">SO-239 bulkhead connector</a>   | <a href="#">Crimp sleeves</a> (optional)              |
| <a href="#">#8 screws, nuts, flat washers, split washers</a>                                      | 4 each M3 <a href="#">screws, split washers, nuts</a> |
| Four <a href="#">dogbone insulators</a> (you can fabricate these from ½" PVC, about 3" long each) |   |

### Transformer-less "balun" construction

Drill a 3/16" hole in the center of one of the slip caps, and install an eye bolt through a flat washer on the outside of the cap. Slip another flat washer onto the eye bolt on the inside, followed by a split washer, then tighten a nut onto the eye bolt of the slip cap assembly and set aside.

Drill a 7/16" hole in the center of the other slip cap. If your slip cap is domed (most are), rather than flat, it'll help with the installation to sand the outside of the cap so that the entire flange of the SO239 bulkhead sits flush with the cap. Insert the solder end of the SO-239 bulkhead into the 7/16" hole on the outside of the cap, and using the mounting holes of the bulkhead as a template, drill a 1/8" hole for each mounting hole. Drill two more 1/8" holes in the slip cap next to the SO-239 bulkhead flange, to allow for drainage of rain water that might collect inside the balun.

Cut the speaker wire into two 6-inch pairs. Strip both sides of each end of both 6" speaker wire pairs. For each pair, solder a #8 ring terminal to each conductor of one end, and a #4 ring terminal to one of the conductors of the other end. Slip a piece of heat



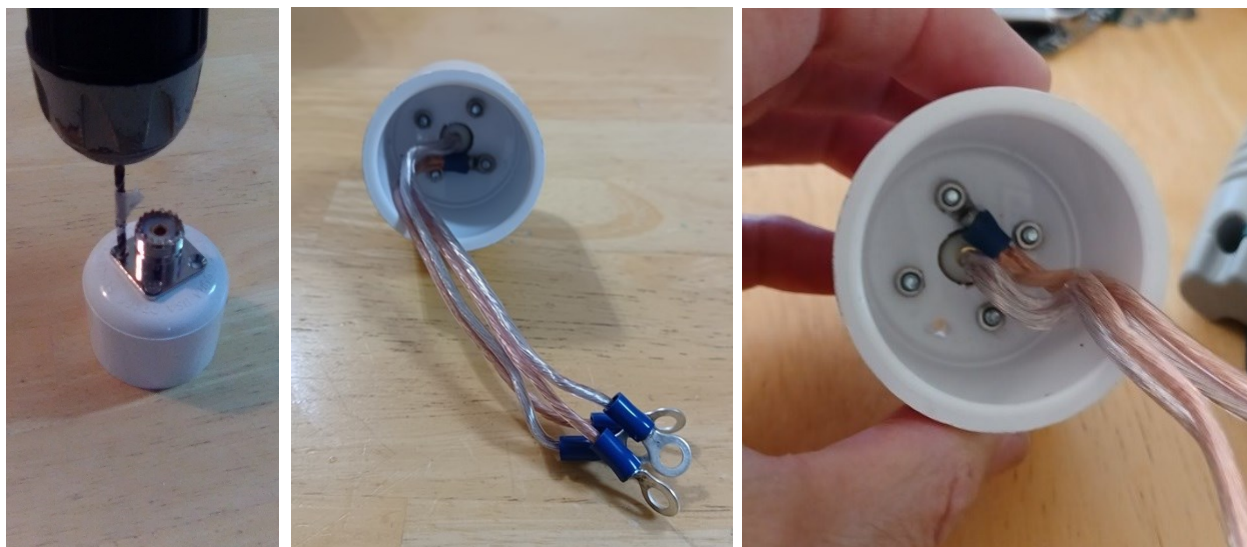


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shrink tubing over the remaining conductors, then solder them to the center pin of the SO-239 bulkhead, and shrink the tubing. Use the metric screws, washers, and nuts to bolt the SO-239 bulkhead to the slip cap, including the #4 ring terminal to one of the screws inside of the cap.



Cut a 3-1/2" section off of the 24" PVC tube. Drill a 3/16" hole in the side of the PVC tube 1-1/2" from one end, which I'll refer to as the top end. Drill another 3/16" hole just 1/2" below the top hole, placing it 1-1/2" from the bottom end. Slip an eye bolt through a flat washer into the top hole, and tighten a washer and nut to it on the inside. Screw a nut onto a 1" #8 screw, and slip the pair through one of the #8 ring terminals of the speaker wire, then through the bottom hole from the inside. Tighten a nut and washer onto the screw assembly from the outside. Repeat these two on the three other sides, 90 degrees apart from each other. Place the two assembled caps onto the tube, and the balun is complete. Once you make sure the connections are electrically continuous, you're free to glue the caps on.





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### Element construction

Cut two 14 AWG wires 27 feet long for the 40-meter elements, and two more 40 feet long for the 80-meter elements, making each two feet longer than they need to be, for strain-relief. Thread each element wire through a crimp sleeve (or other strain-relief device), through one of the balun eye bolts, then back through the crimp sleeve. Solder a #8 ring terminal to the end of the wire exiting the crimp sleeve, fasten the ring terminal to the balun with a nut, then crimp the sleeve. Thread the other end of the element wire through another crimp sleeve, through a dogbone insulator, then back through the crimp sleeve.



For the 40-meter elements, measure 25 feet 0 inches between the balun eye bolt and the dogbone insulator, then crimp the sleeve. For the 80-meter elements, measure 38 feet 0 inches between the balun eye bolt and the dogbone insulator, then crimp the sleeve. Repeat this with all the elements, mounting the two 40-meter elements opposite each other and 80-meter elements opposite each other.





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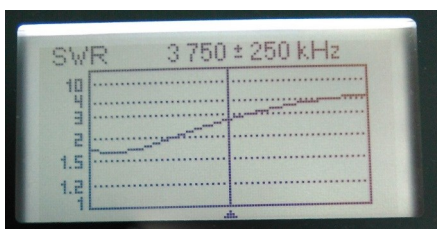
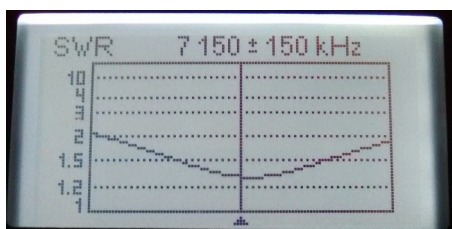
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### Test time

With all the element wires laid out from the balun, I connected the coax to the SO-239 bulk-head connector, then raised the balun onto a stack of four 4-foot fiberglass military poles. For convenience, I ran the coax down through the poles, and drilled a  $\frac{3}{4}$ " hole in the side of the bottom pole, about ten inches from the very bottom, for the coax to exit. I then tied paracord element wires and 7 feet for the 80-meter element wires. This forms each side into a 45-foot-long slope, making the entire footprint a square of about  $\sqrt{(45^2 - 16^2)} \times \sqrt{2} \approx 60$  feet per side.

Because my transceiver needed to sit outside the perimeter of the antenna, to prevent unwanted coupling and interference, I had to use coax that was at least 60 feet long, so I used a 75-foot-long length of [RG-8X I had purchased from Amazon](#) from a couple of years back, and it came with molded PL-259 connectors. I wasn't



too worried about the loss, since the attenuation of RG-8X at 40 meters is around [1.0 dB per 100 feet](#), making  $(1.0 \text{ dB} \times 0.75 = ) -0.75 \text{ dB}$ , or about 16%, which is hardly noticeable, and even less loss at 80 meters.

### In the end

This military-based design of an NVIS antenna seems to both measure better and work better than the one previously published in the newsletter. The SWR across 80 meters was far from perfect, but my tuner easily brought that within workable range.

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